Lighting Controls

Requirements for Design

ASHRAE/IESNA 90.1

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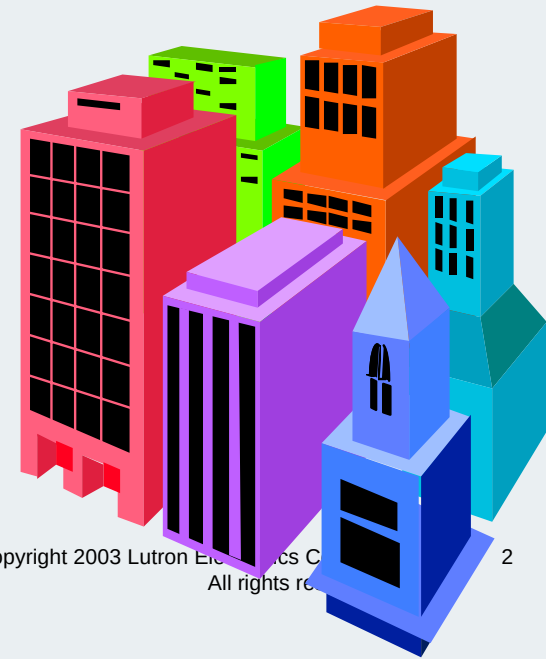
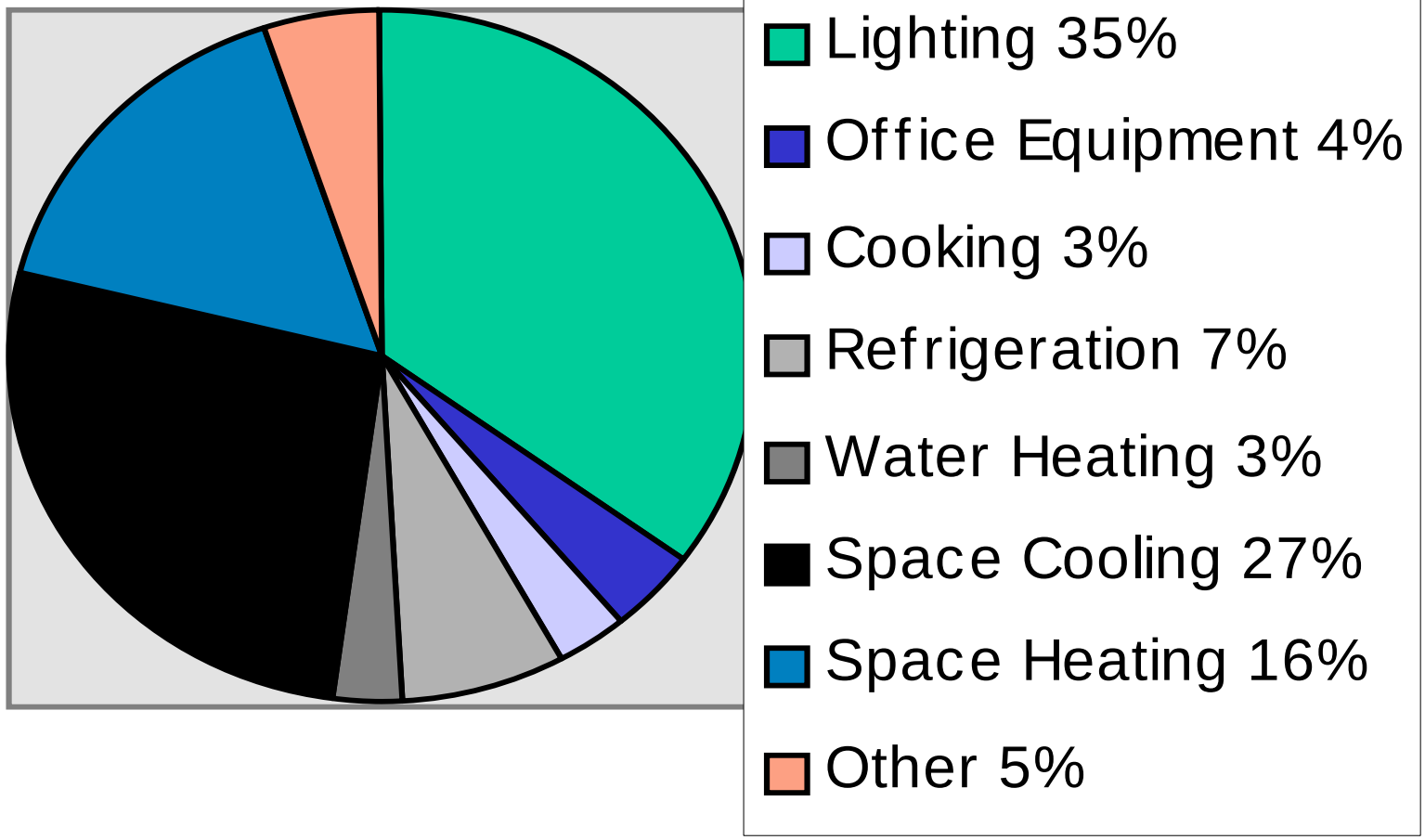
Agenda

- Overall lighting codes review
- Controls Requirements in ASHRAE/IESNA 90.1
- Designing control systems
- Products and technology today



Energy Profile



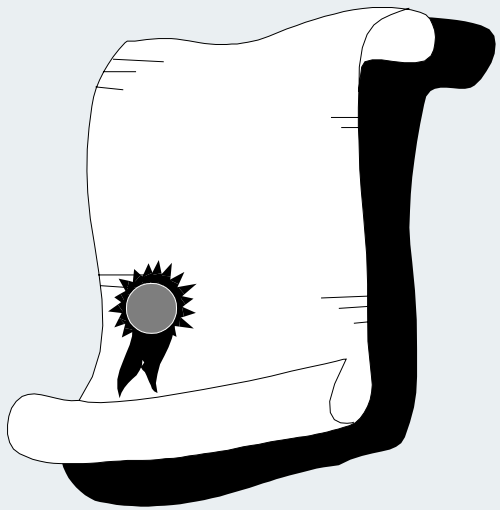
Codes, ordinances, standards related to Lighting

Model Codes (NFPA 70-2002, IECC, etc.)

- Documents intended to be adopted into law

Laws and Ordinances

- Actual laws
- May include, modify or expand on model codes
- May be federal, state or local



Codes, ordinances, standards related to Lighting

Standards (ASHRAE, IES, NECA, NEMA)

- Documents intended to be incorporated into specifications

Initiatives

- Not legally required
- Choice based
- Affects design decisions

Model Codes Involving Lighting

National Electric Code NFPA-70-2002

- Regulates applications of lighting equipment
- Concerned with electrical safety

Energy Efficiency Code ASHRAE/IESNA 90.1-2001

- Regulates the amount of power allocated to lighting
- Regulates controls and other specific energy-related application details

NFPA 101 Life Safety Code

- Concerned with egress path illumination

Model Codes Involving Lighting

Building Codes (IBC, etc.)

- Tend to be concerned with egress path illumination

International Energy Conservation Code(IECC)

- Part of international Building Code series
- An alternative to 90.1 which is essentially equivalent
- 2002 IECC employs 90.1-2001

Important Standards Affecting Lighting Design

Construction Standards:

- NECA/IESNA500 Series National Electrical Installation Standards (NEIS)
- IESNA Recommended Practices
- IESNA Handbook (currently 9th Edition)

Important Standards Affecting Design

Electrical Safety Standards:

- Listing Standards by Underwriters Laboratories
- Listings by Testing Laboratories

Owner/Developer Standards

- Specific tenant standards

Initiatives

Green Initiatives

- LEED rating system
- Daylighting Initiatives

Energy Efficiency Initiatives

- Energy Star Program (US EPA)
- Regional Programs
- Utility rebates

IESNA Role in the Lighting Requirements

- Co-sponsor with ASHRAE
- Looking out for lighting issues
  - Standard 90.1
  - Standard 90.2 (residential)
  - Standard 100 (existing buildings)
  - SP102(+30%)

Overview of the standard

We will review the Lighting controls requirements in 90.1

Mandatory Provisions - Interior

9.2.1.1 Automatic Lighting Shut Off

Interior lighting in buildings larger than 5000 ft^2 shall be controlled with an automatic control device to shut off building lighting in all spaces. This automatic control device shall function on either:

a. a scheduled basis using a time-of-day operated control device that turns lighting off at specific programmed times – an independent program schedule shall be provided for areas of no more than 25,000 ft^2 but not more than one floor – or

b. an occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space – or

c. a signal from another control or alarm system that indicates the area is unoccupied.

Mandatory Provisions - Interior

Exception to 9.2.1.1:

> "*Lighting intended for 24-hour operation shall not require an automatic control device.*"

Mandatory Provisions - Interior

9.2.1.2 Space Control

Each space enclosed by ceiling height partitions shall have at least one control device to independently control the general lighting within the space. Each control device shall be activated either manually by an occupant or automatically by sensing an occupant. Each control device shall

a. control a maximum of 2500 ft^2 area for a space 10,000 ft^2 or less and a maximum of 10,000 ft^2 area for a space greater than 10,000 ft^2 ,

b. be capable of overriding the shutoff control required in 9.2.1.1 for no more than four hours, and

c. be readily accessible and located so the occupant can see the controlled lighting.

Mandatory Provisions - Interior

Exception to 9.2.1.2:

"*Remote location shall be permitted for reasons of safety or security when the remote control device has an indicator pilot light as part of or next to the control device and it shall be clearly labeled to identify the controlled lighting.*"

Mandatory Provisions

9.2.1.4 Additional Control

a. Display/Accent Lighting – display or accent lighting shall have a separate control device

b. Case lighting – lighting in cases used for display purposes shall have a separate control device.

c. Hotel and Motel Guest room Lighting – hotel and motel guest rooms and suites shall have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles.

Mandatory Provisions

9.2.1.4 Additional Control

d. Task lighting – Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall- mounted control device provided the control device is readily accessible and located so that the occupant can see the controlled lighting.

Mandatory Provisions

9.2.1.4 Additional Control

e. Non-visual Lighting – lighting for non-visual applications, such as plant growth and food warming, shall have a separate control device.

f. Demonstration Lighting – Lighting equipment that is for sale or for demonstration s in lighting education shall have a separate control device.

Provisions not Included

- Daylight Sensing controls
  - No zone independent zone requirement
  - No control device or sensor requirement
- Two level switching
  - Dual switching of interior lighting not required
  - Separate control for task lights is required

Mandatory Provisions - Exterior

9.2.1.3 Exterior Lighting Control

"*Lighting for all exterior applications not exempted in 9.1 and 9.3.2 shall be controlled by a photosensor or astronomical time switch that is capable of automatically turning off the exterior lighting when sufficient daylight is available or the lighting is not required*"

Exterior Exceptions

Exceptions to 9.1

(a) emergency lighting that is automatically off during normal building operation,

(b) lighting within living units

(c) lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation,

(d) decorative gas lighting systems.

Exceptions to 9.3.2 (Exterior Building Lighting Power)

Exterior Exceptions

Exceptions to 9.3.2 (Exterior Building Lighting Power)

Lighting for the following exterior applications is exempt when equipped with an independent control device:

(a) *Specialized signal, directional, and marker lighting associated with transportation;*

(b) *Lighting used to highlight features of public monuments and registered landmark structures or buildings; and*

(c) *Lighting that is integral to advertising signs*

Control Products - Interior

Today's control systems have the ability to provide for the provisions of the current standard and codes

- Automatic Lighting shut-off (9.2.1.1)
  - Occupancy Sensors
    - » A typical way to provide Automatic shut off of lighting in a space
  - Astronomical Time switch controls
    - » Provides automatic shut off at programmed times

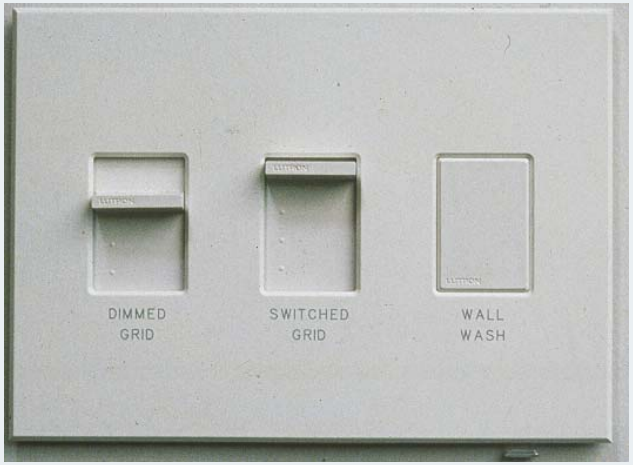
Control Products - Interior

Today's control systems have the ability to provide for the provisions of the current standard and codes

- Space Control (9.2.1.2)
  - Switching system
    - » Remote, low voltage on/off switches
    - » Panel mounted relays control power
    - » Integral time switch/time delay functions

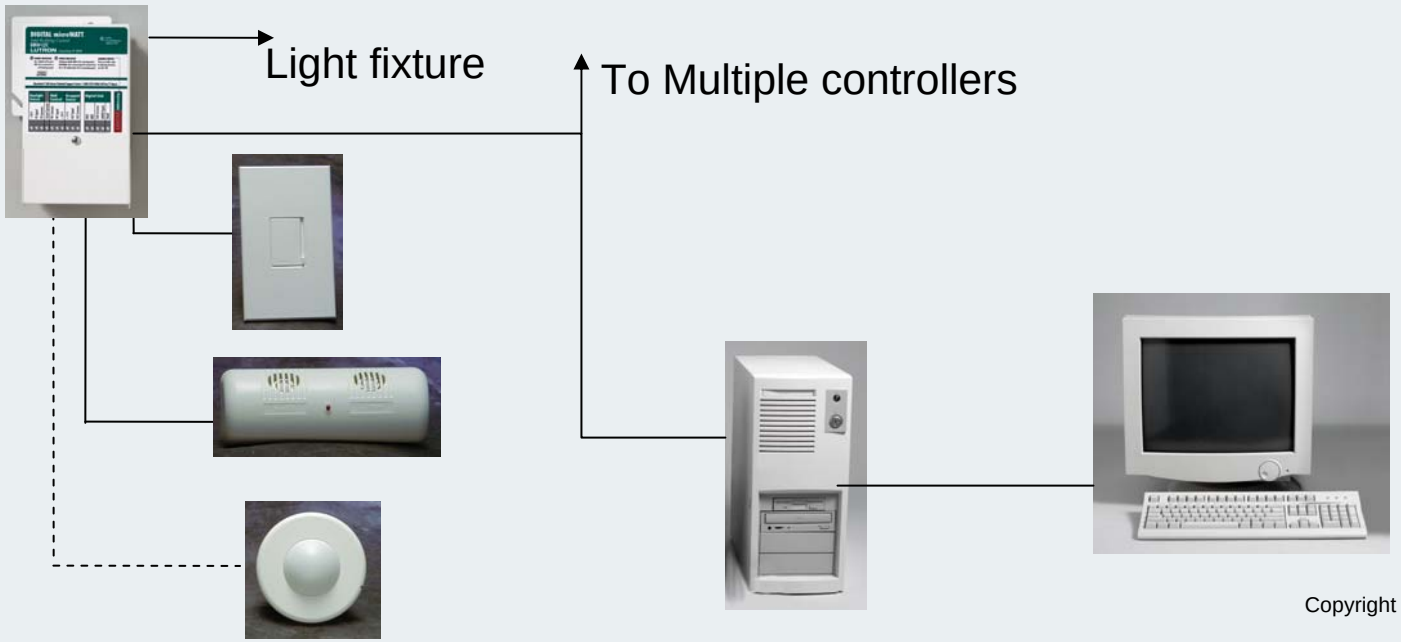
Control Products - Interior

- Additional Control (9.2.1.4)
  - Manual Switches and Dimmers
    - » Meets requirement for a separate control device



Control Products - Interior

- Lighting Control (9.2.1) [all provisions]
  - Whole Building Digital control systems
    - » Complete control provides all required functions
    - » In addition provides monitoring and reporting functions



Control Products - Exterior

Control systems to provide for the provisions of the exterior requirements

- Exterior Lighting Control (9.2.1.3)

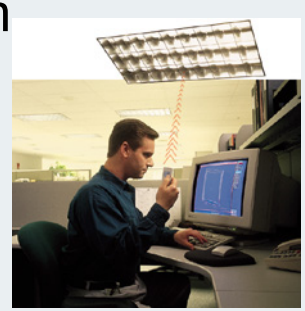
  - Photo Sensors
    - » The typical way to provide Automatic shut off of lighting when daylight is available
  - Astronomical Time switch controls
    - » Provides automatic turn on/shut off at programmed times
    - » Track changes in sunrise/sunset

  - Combined Photo sensor/ time switch systems
    - » Provide optimum control
    - » Allow for weather variables
    - » Include motion sensors for greater control - where appropriate

Control Products - Emerging systems

The latest Control Systems have the ability to provide for the provisions of the Future Standards, Codes and Guidelines

- Examples include:
  - Daylight Sensors
    - Provide automatic control of lighting in spaces with natural day light
  - Personal Lighting Controls
    - Individual user control of lighting
    - Studies verify productivity improvements
  - Fluorescent Dimming Ballasts
    - Allows for continuously adjustable lighting for tuning of light levels, daylight control and personal controls
  - Automatic Window Shade Control
    - Provide total integration of day-lighting and electric lighting



Lighting Changes are on the way

- ASHRAE/IESNA 90.1-2004
  - Occupant sensor requirements
    - » Mandatory in specific spaces
- Proposed energy guide SP102
  - Advanced Energy Design Guide: Small Office Buildings
    - » Additional saving of 30% over 90.1
    - » Simple approach for use by Designers and Contractors

Example of Whole Building System

- Recent project that incorporates all aspects of the latest lighting control technologies
- Meets the controls requirements of 90.1

Agere Microelectronics Campus Expansion

Agere Microelectronics Campus Expansion

Architect: Kevin Roche John Dinkeloo & Associates

MEP Engineer: R.G. Vanderweil, Boston, MA

General Contractor: Sordoni Skanska

Requirements:

- Work in harmony with the environment
  - Innovation in energy efficiency
- Low energy cost:
  - Energy usage
  - Peak demand management
- Attract and retain top talent
- Adaptable, responsive to change
- Meet a budget

Solutions:

Central lighting control:

occupant sensors

local wall box switching

time clock controls

high-end tuning

daylight harvesting

real time monitoring

peak load limiting

system “interoperability” w/ BMS

Solutions:

- Personal lighting controls
  - empowerment, satisfaction w/ work environment
  - energy
  - adaptability
  - budget

Typical Floor Plan

Areas:

Open plan, perimeter

Open plan, interior

Corridor

Private Offices

Controls:

Astro time clock

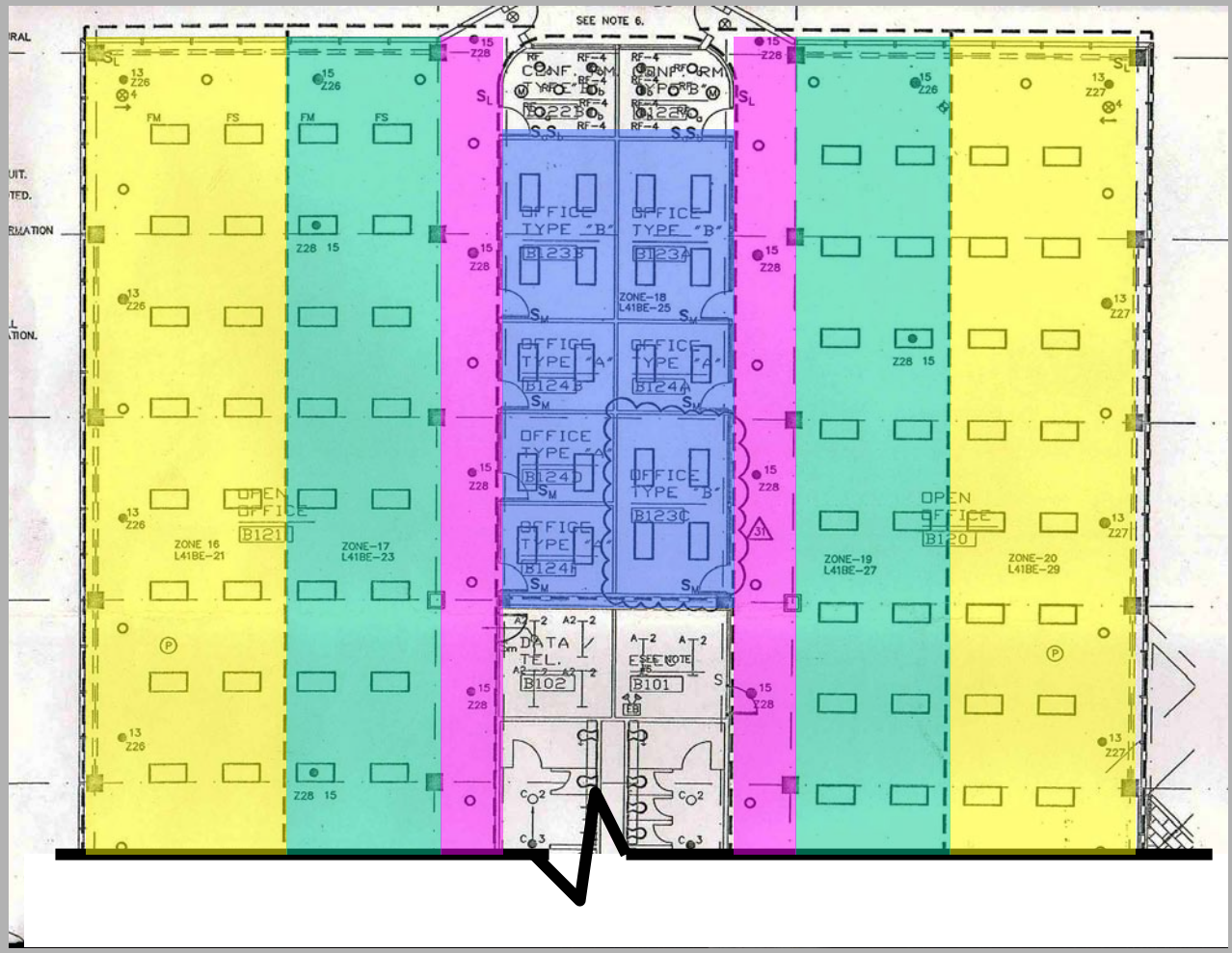
Tuning

Daylighting

Personal control

Occupancy control

Metering, integration

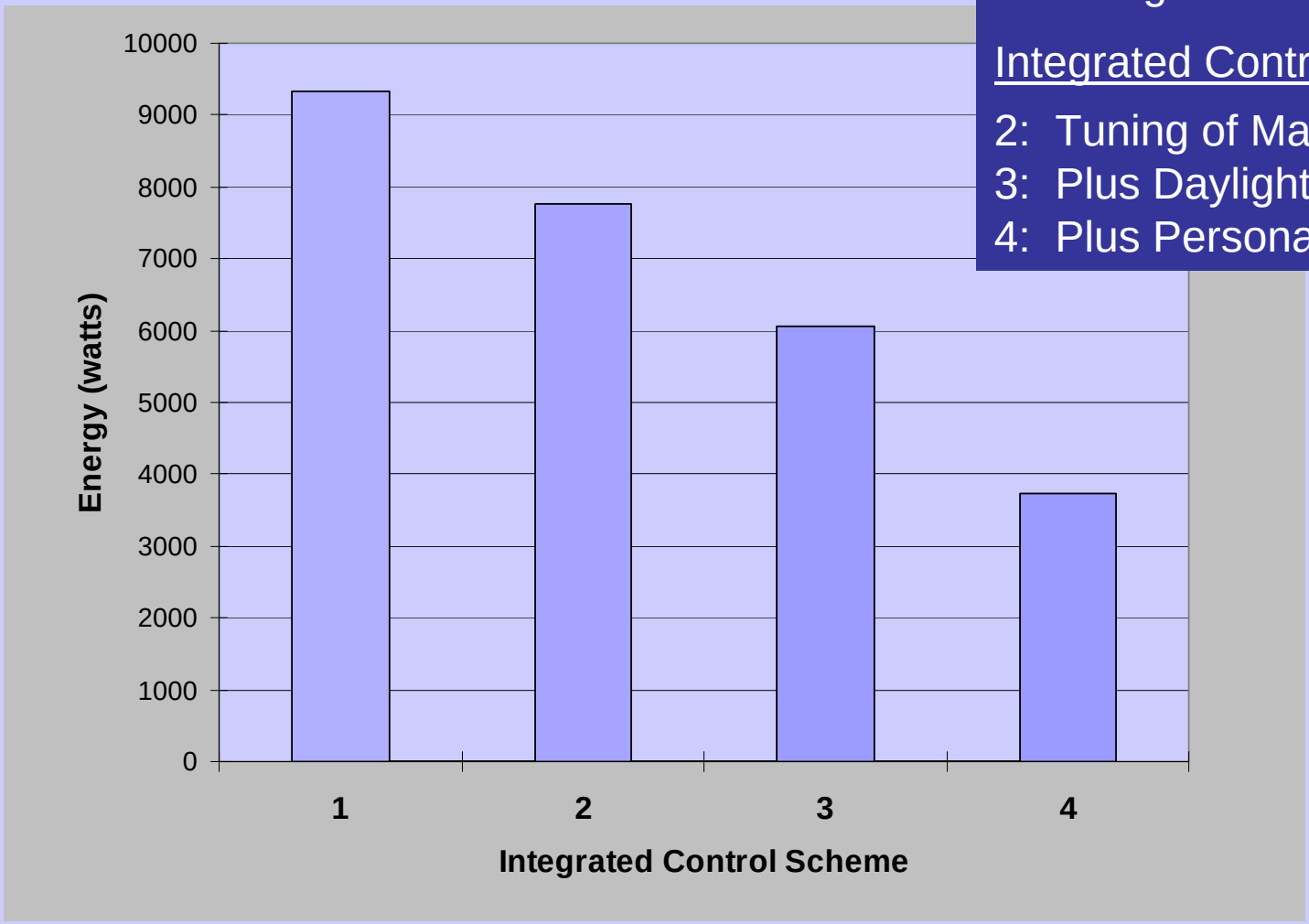


Typical Performance

1: Design watts

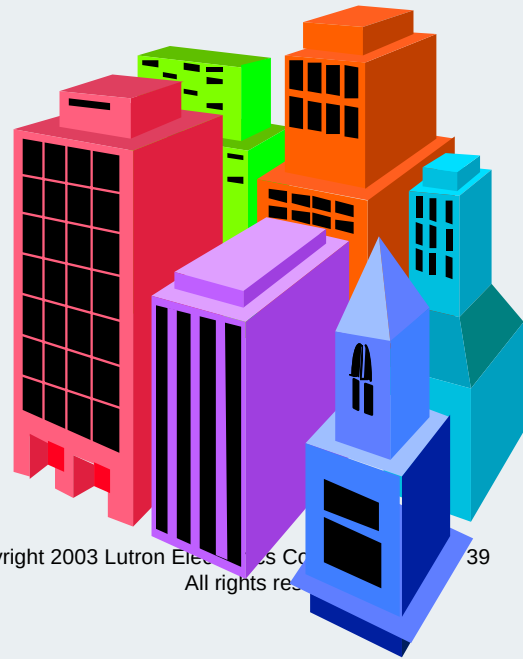
Integrated Controls:

2: Tuning of Max. Output
3: Plus Daylighting
4: Plus Personal Control

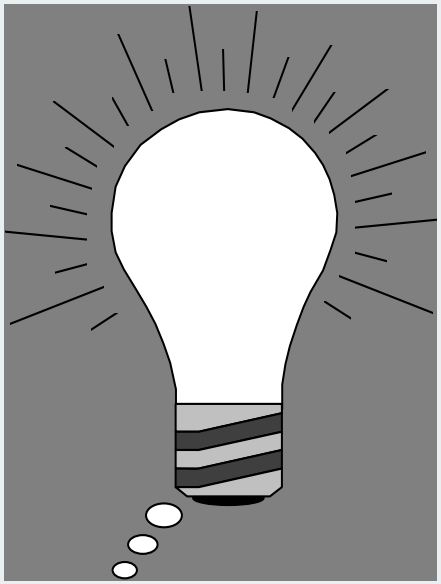


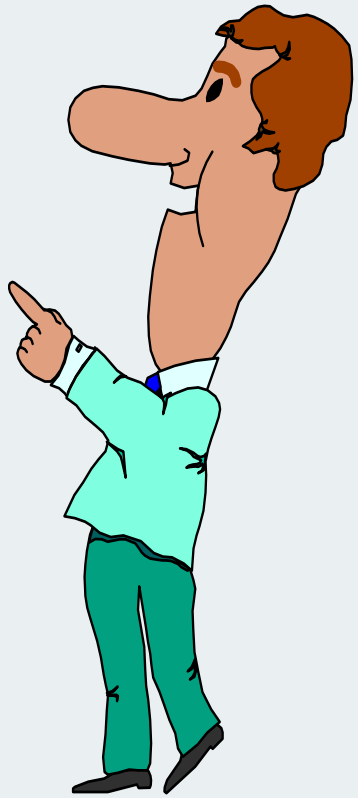
Summary

- Looked at related lighting standards and codes
- Reviewed 90.1 Controls requirements
- Provided some insight into how to best meet the standard
- Reviewed control types that provide for the requirements of the standard



QUESTIONS / COMMENTS / INSPIRATIONS





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